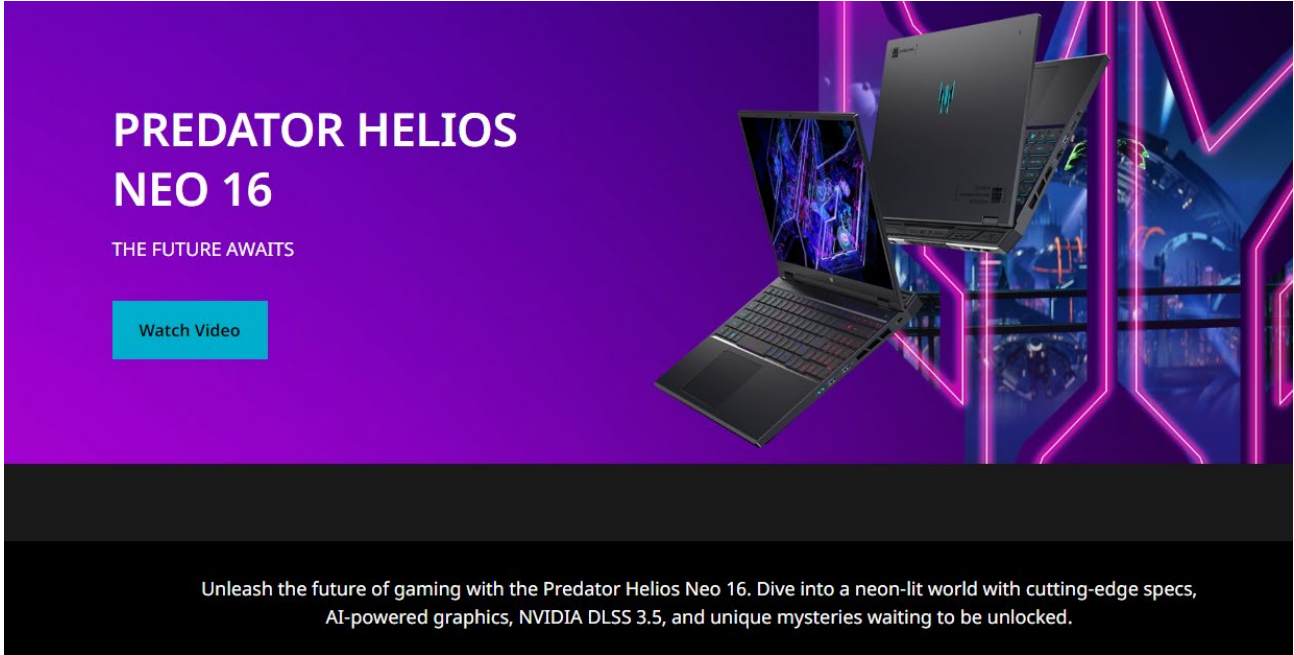
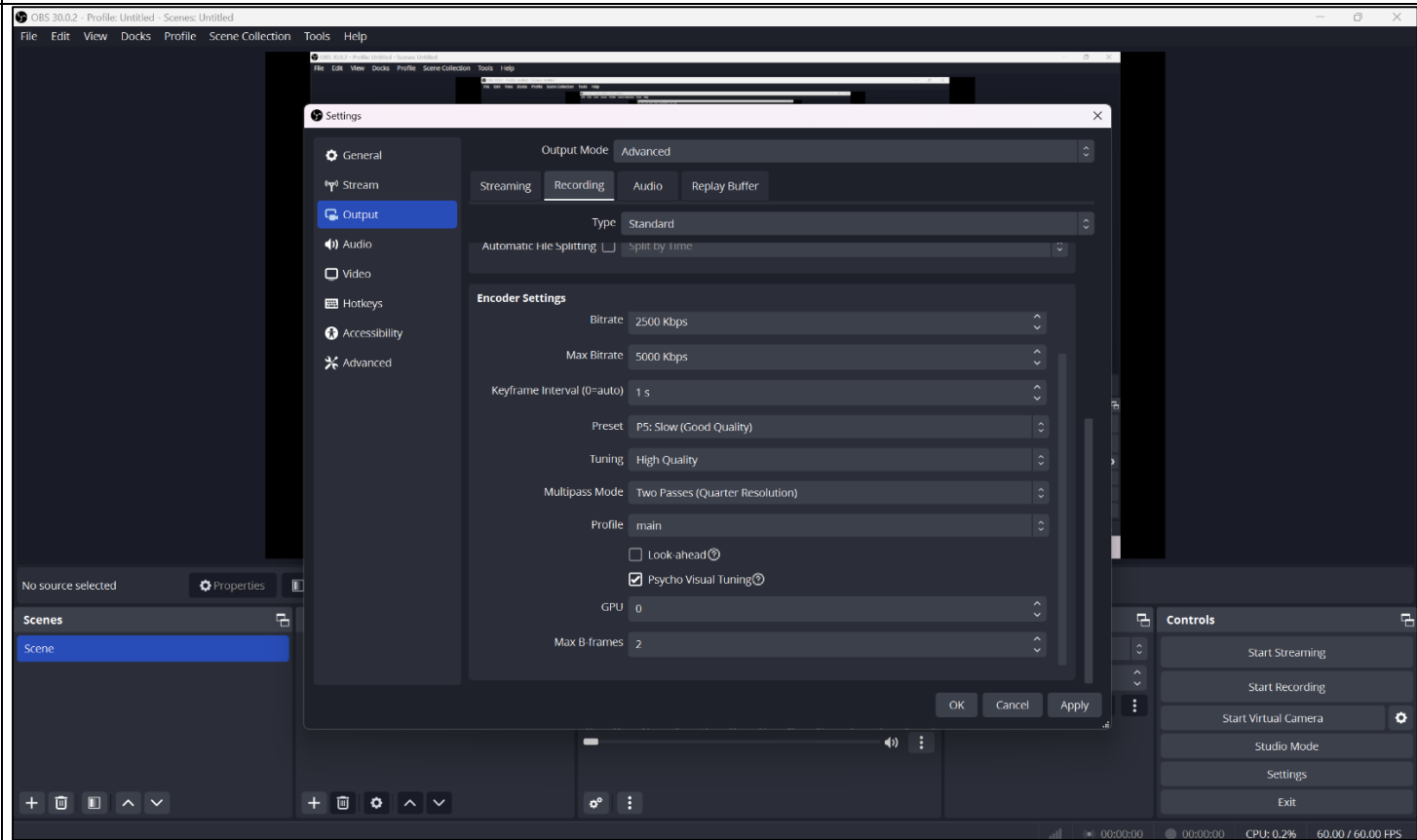


**Exhibit 8: U.S. Patent No. 9,179,147**

Claims	Identification
<p>10[pre] A video encoder for encoding a video by obtaining an optimal sequence of quantized coefficients for a block of transform residuals from the video, the video encoder comprising:</p>	<p>To the extent the preamble is limiting, Acer-branded devices implement a video encoder for encoding a video by obtaining an optimal sequence of quantized coefficients for a block of transform residuals from the video.</p>  <p>The image is a promotional banner for the Acer Predator Helios Neo 16 laptop. It features a dark purple background with glowing neon blue and pink lines forming a geometric pattern. Two laptops are shown: one in the foreground, open and displaying a game, and another behind it, also open. The text 'PREDATOR HELIOS NEO 16' is prominently displayed in white, with 'THE FUTURE AWAITS' below it. A blue 'Watch Video' button is on the left. At the bottom, a black bar contains white text describing the laptop's features: 'Unleash the future of gaming with the Predator Helios Neo 16. Dive into a neon-lit world with cutting-edge specs, AI-powered graphics, NVIDIA DLSS 3.5, and unique mysteries waiting to be unlocked.'</p> <p>Source: <a href="https://www.acer.com/us-en/predator/laptops/helios/helios-neo-16#filterHeader">https://www.acer.com/us-en/predator/laptops/helios/helios-neo-16#filterHeader</a></p>

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**Claims****Identification**

Source: Internal Testing of Acer Predator Helios Neo 16 Gaming Laptop.

Claims

Identification

Task Manager

Processes

Performance

App history

Startup apps

Users

Details

Services

Settings

Performance

CPU

5% 2.06 GHz

Memory

7.2/31.7 GB (23%)

Disk 0 (C:)

SSD 2%

Wi-Fi

S: 24.0 R: 448 Kbps

GPU 0

Intel(R) UHD Graphics 7%

GPU 1

NVIDIA GeForce RTX ... 25% (51 °C)

GPU

3D

Video Processing 8%

Video Encode

Video Decode 25%

Dedicated GPU memory usage

8.0 GB

Shared GPU memory usage

15.9 GB

Utilization

25%

Dedicated GPU memory

0.7/8.0 GB

GPU Memory

0.8/23.9 GB

Shared GPU memory

0.1/15.9 GB

GPU temperature

51 °C

Driver version:

31.0.15.3210

Driver date:

6/4/2023

DirectX version:

12 (FL 12.1)

Physical location:

PCI bus 1, device 0, function 0

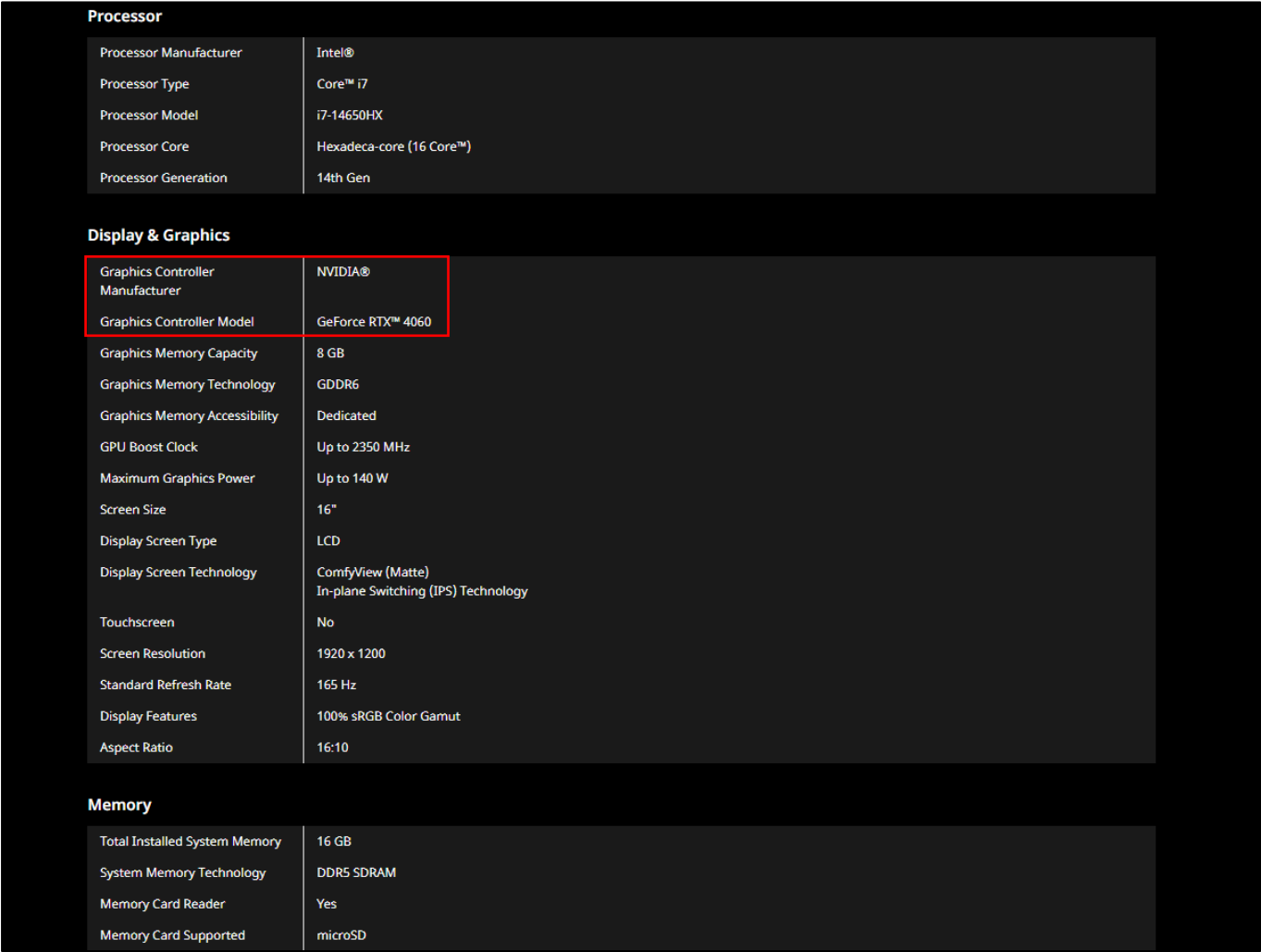
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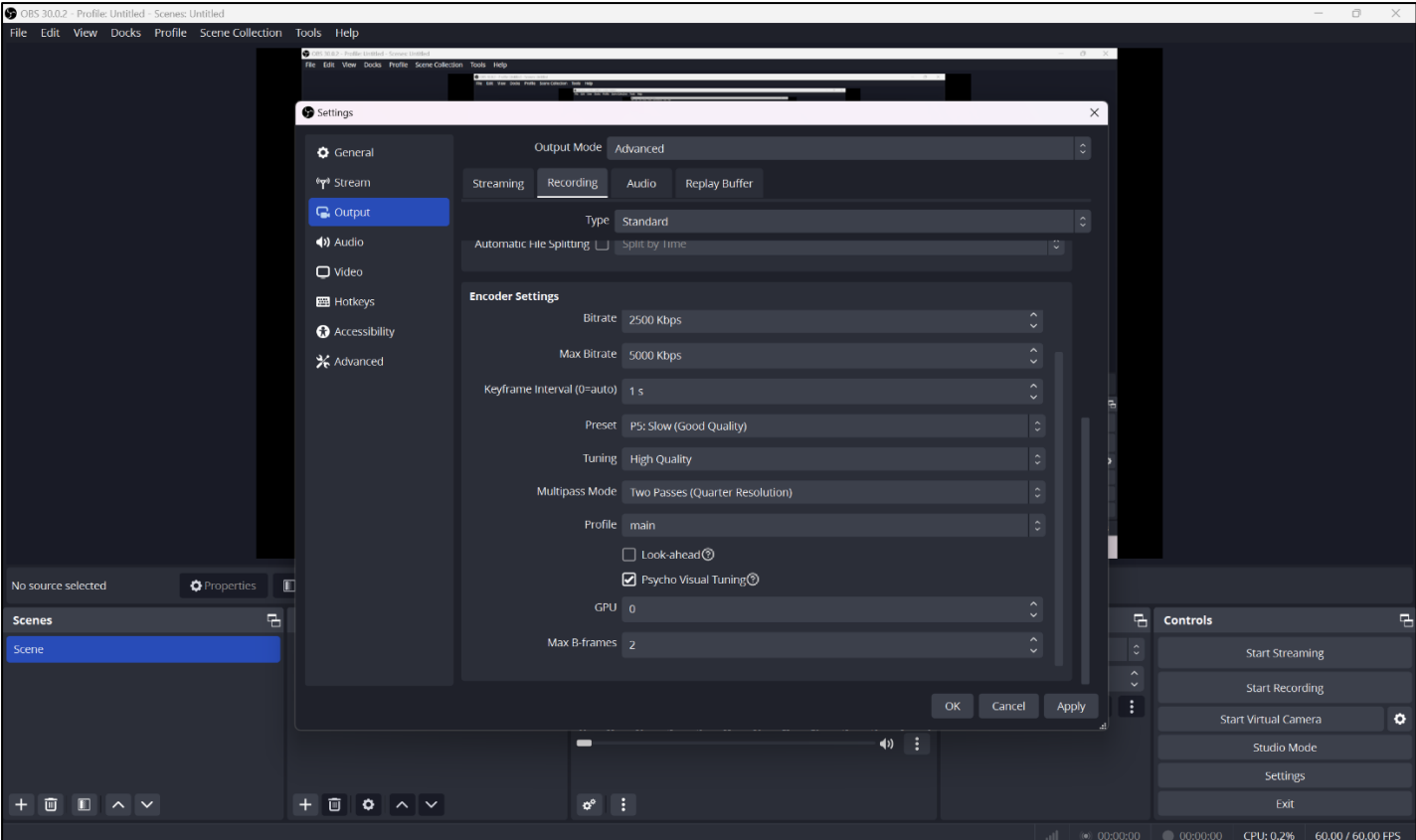
221 MB

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Claims	Identification														
	<p><b>Joint Collaborative Team on Video Coding (JCT-VC) of ITU-T SG16 WP3 and ISO/IEC JTC1/SC29/WG11</b> Document: JCTVC-Software Manual</p> <p><i>Title:</i> HM Software Manual</p> <p><i>Status:</i> Software AHG working document</p> <p><i>Purpose:</i> Information</p> <p><i>Author(s):</i> Frank Bossen David Flynn Karl Sharman Karsten Sühning</p> <p><i>Source:</i> AHG chairs</p> <p><i>frank@bossentech.com</i> <i>dflynn@blackberry.com</i> <i>karl.sharman@eu.sony.com</i> <i>karsten.suehring@hhi.fraunhofer.de</i></p> <hr/> <p><b>Abstract</b></p> <p><u>This document is a user manual describing usage of reference software for the HEVC project. It applies to version 16.8 of the software.</u></p> <p><b>Contents</b></p> <table> <tr> <td><b>1 General Information</b></td><td><b>2</b></td></tr> <tr> <td><b>2 Installation and compilation</b></td><td><b>2</b></td></tr> <tr> <td><b>3 <u>Using the encoder</u></b></td><td><b>3</b></td></tr> <tr> <td>3.1 GOP structure table . . . . .</td><td>3</td></tr> <tr> <td>3.2 Encoder parameters . . . . .</td><td>7</td></tr> <tr> <td>3.3 Encoder SEI parameters . . . . .</td><td>19</td></tr> <tr> <td>3.4 Hardcoded encoder parameters . . . . .</td><td>27</td></tr> </table> <p>Source: HEVC Encoder Manual (<a href="https://github.com/listenlink/HM/blob/master/doc/software-manual.pdf">https://github.com/listenlink/HM/blob/master/doc/software-manual.pdf</a>), 1</p>	<b>1 General Information</b>	<b>2</b>	<b>2 Installation and compilation</b>	<b>2</b>	<b>3 <u>Using the encoder</u></b>	<b>3</b>	3.1 GOP structure table . . . . .	3	3.2 Encoder parameters . . . . .	7	3.3 Encoder SEI parameters . . . . .	19	3.4 Hardcoded encoder parameters . . . . .	27
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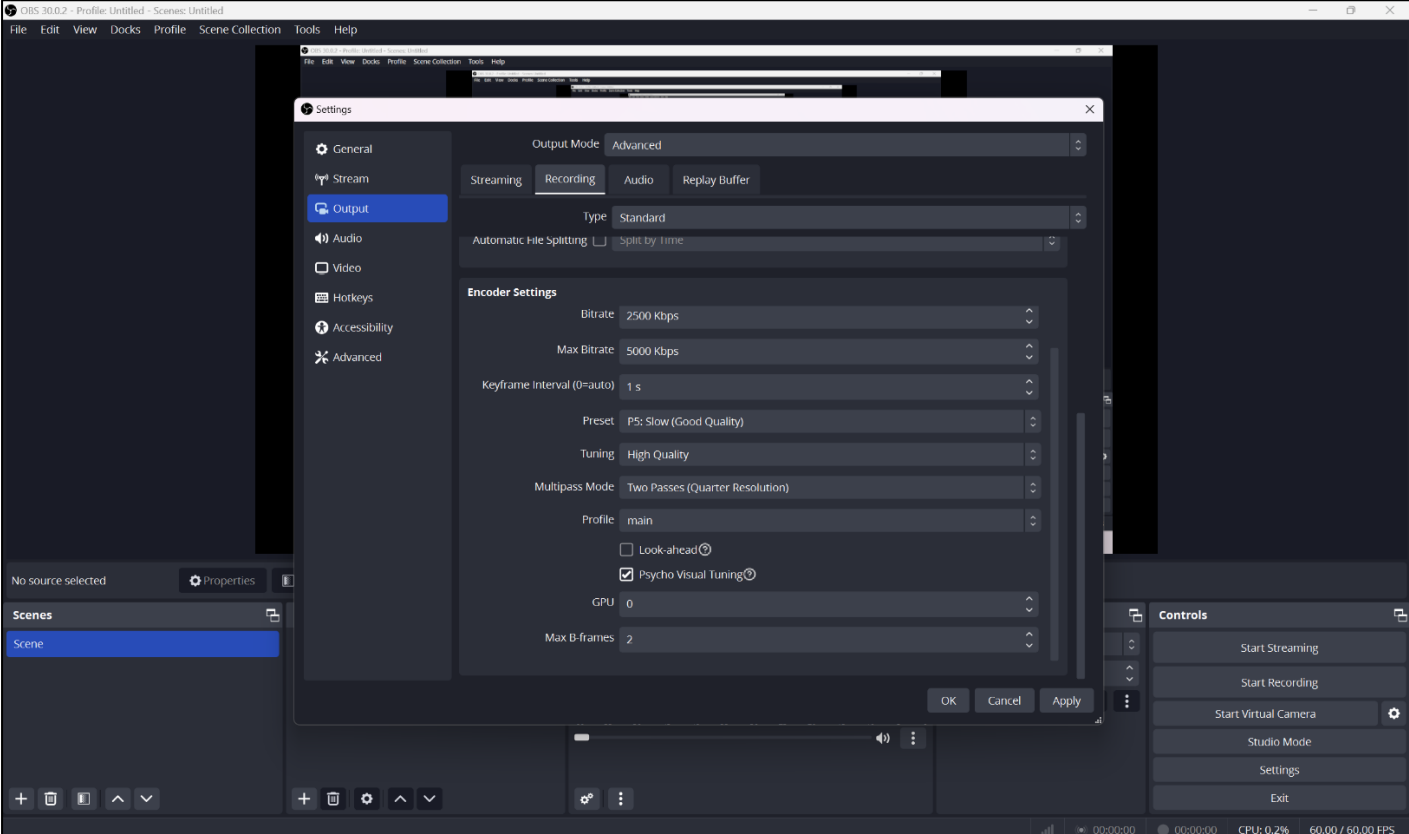
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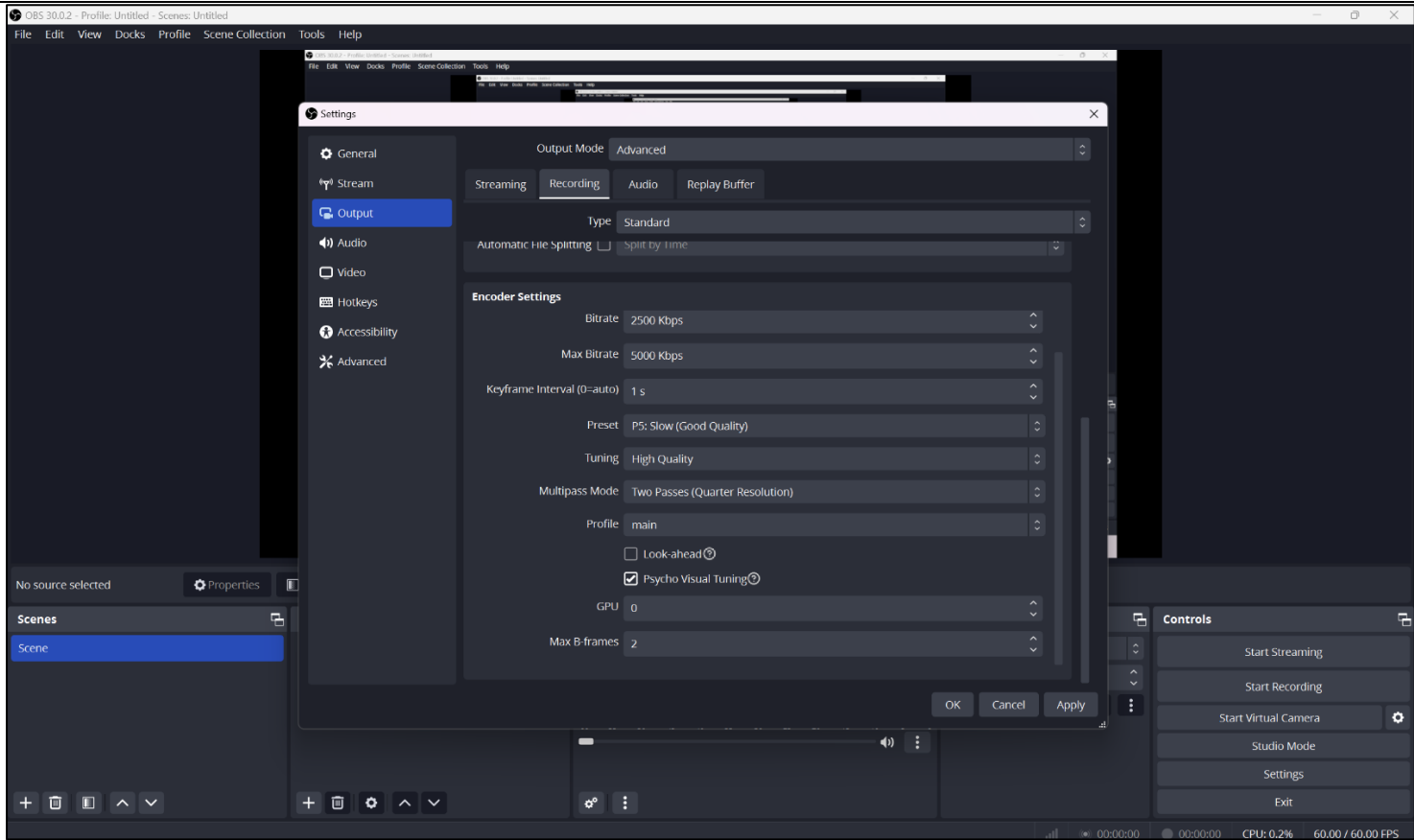
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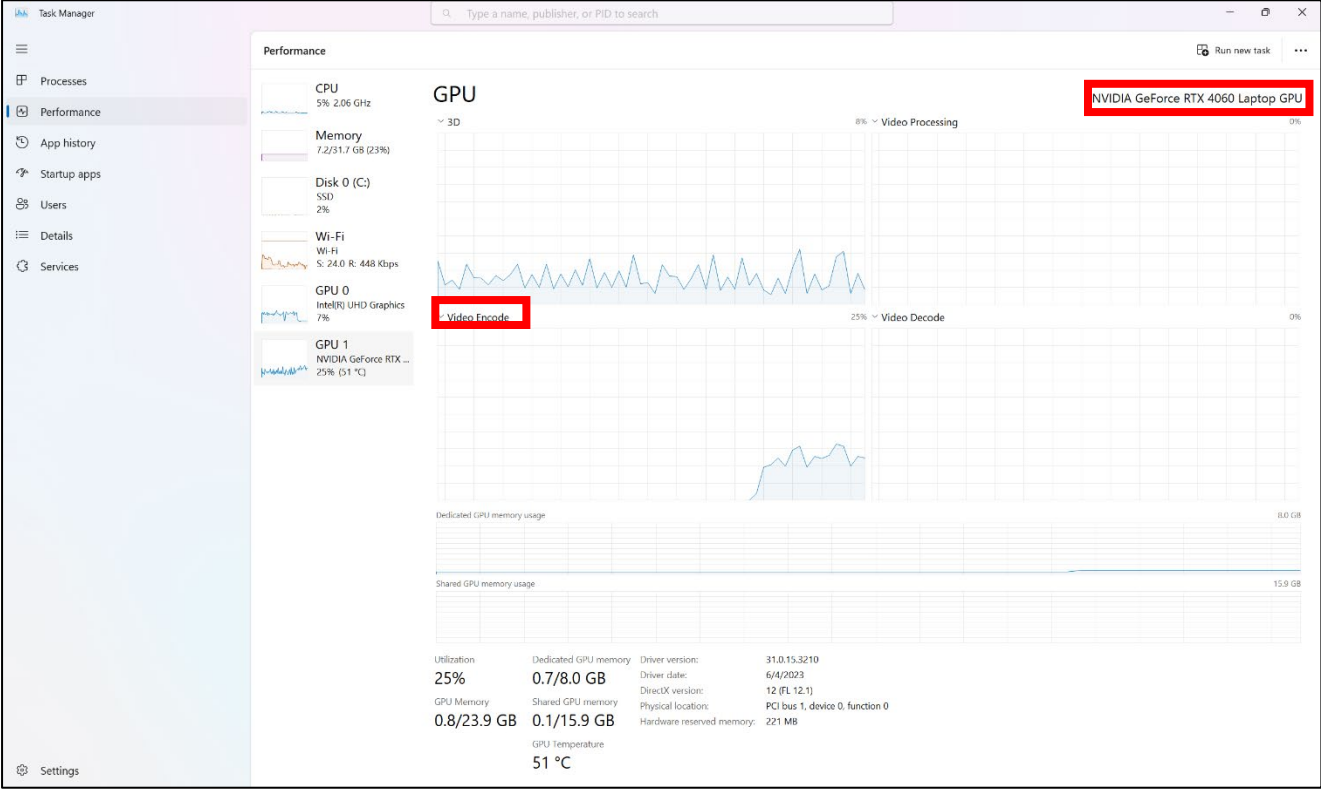
Claims	Identification
	 <p>The screenshot shows the OBS Studio 30.0.2 interface with the Settings window open to the Output tab. The Output Mode is set to Advanced. Under the Recording tab, the Type is Standard, and Automatic File Splitting is disabled. The Encoder Settings section shows Bitrate at 2500 kbps, Max Bitrate at 5000 kbps, Keyframe Interval at 1 s, Preset at P5: Slow (Good Quality), Tuning at High Quality, Multipass Mode at Two Passes (Quarter Resolution), Profile at main, Look-ahead disabled, Psycho Visual Tuning enabled, GPU at 0, and Max B-frames at 2. The bottom status bar indicates CPU usage at 0.2% and 60.00 / 60.00 FPS.</p> <p>Source: Internal Testing of Acer Predator Helios Neo 16 Gaming Laptop.</p>
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Memory Card Supported	microSD																																																

Claims	Identification
	 <p>Source: Internal Testing of Acer Predator Helios Neo 16 Gaming Laptop.</p>
10[c] a video encoding application executable by the processor and which, when executed, configures the processor to:	Acer-branded devices implement a video encoder that comprises a video encoding application executable by the processor.

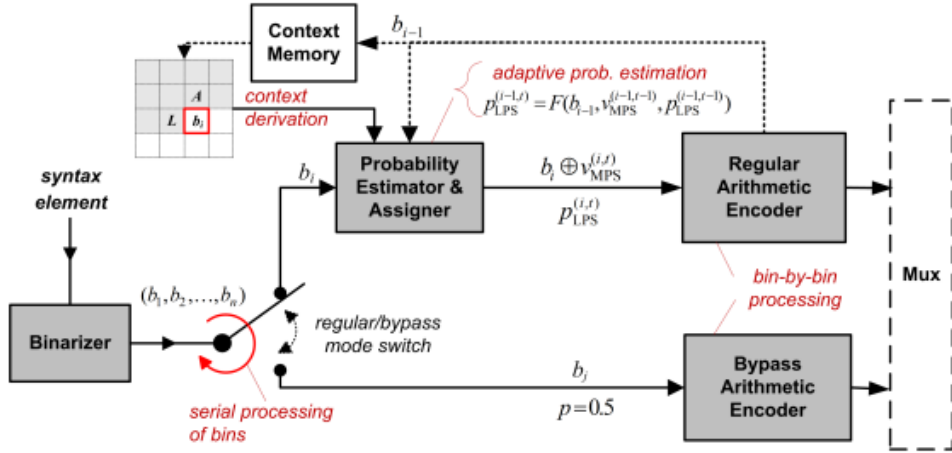
Claims	Identification
	 <p>The screenshot displays the OBS Studio 30.0.2 interface. The 'Settings' window is open, showing the 'Recording' tab under 'Output Mode: Advanced'. The 'Type' is set to 'Standard'. Under 'Encoder Settings', the 'Bitrate' is 2500 Kbps, 'Max Bitrate' is 5000 Kbps, 'Keyframe Interval (0=auto)' is 1 s, 'Preset' is P5: Slow (Good Quality), 'Tuning' is High Quality, 'Multipass Mode' is Two Passes (Quarter Resolution), 'Profile' is main, 'Look-ahead' is unchecked, 'Psycho Visual Tuning' is checked, 'GPU' is 0, and 'Max B-frames' is 2. The 'Controls' panel on the right shows buttons for 'Start Streaming', 'Start Recording', 'Start Virtual Camera', 'Studio Mode', 'Settings', and 'Exit'. The bottom status bar indicates '00:00:00' for both time and CPU usage, with 'CPU: 0.2%' and '60.00 / 60.00 FPS'.</p> <p>Source: Internal Testing of Acer Predator Helios Neo 16 Gaming Laptop.</p>

Claims	Identification
	<div></div> <p>Source: Internal Testing of Acer Predator Helios Neo 16 Gaming Laptop.</p>
10[d] obtain a sequence of quantized coefficients for the block of transform residuals;	<p>Acer-branded devices implement a video encoder that comprises a video encoding application executable by the processor and which, when executed, configures the processor to obtain a sequence of quantized coefficients for the block of transform residuals.</p> <div><p><b>IV. THE RDOQ IN HEVC</b></p><p>The RDOQ has been included in the HEVC reference software (HM) and intensively used during HEVC development and performance. This section describes the RDOQ algorithm adapted to HEVC.</p></div>

Claims	Identification
	<p>Source: Rate-distortion optimized quantization in HEVC: Performance Limitations, 3.</p> <div data-bbox="464 256 1425 732" style="border: 1px solid black; padding: 10px;"> <p><i>A. Quantization of transform coefficients</i></p> <p>In this stage the encoder performs calculation for each of transform coefficients separately. In the first step, <u>the encoder calculates the value <i>Level</i> by quantizing the magnitude of transform coefficient by using the uniform quantizer without dead zone.</u> In the next step, the encoder considers two additional magnitudes of the analyzed quantized coefficient: <i>Level-1</i> and <i>0</i>. For every of the mentioned coefficient magnitudes, the encoder calculates the RD cost of encoding the coefficient with the selected magnitude and chooses the one with the lowest RD cost.</p> </div> <p>Source: Rate-distortion optimized quantization in HEVC: Performance Limitations, 3.</p>
<p>10[e] calculate, for the obtained sequence, a rate-distortion cost based on a distortion cost and on a rate cost based on a context-adaptive entropy encoder, wherein the context-adaptive entropy encoder encodes each quantized coefficient by selecting at least one context from a plurality of contexts by determining an index for a set of contexts based, at least in part, on a previous quantized coefficient in</p>	<p>Acer-branded devices implement a video encoder that comprises a video encoding application executable by the processor and which, when executed, configures the processor to calculate, for the obtained sequence, a rate-distortion cost based on a distortion cost and on a rate cost based on a context-adaptive entropy encoder, wherein the context-adaptive entropy encoder encodes each quantized coefficient by selecting at least one context from a plurality of contexts by determining an index for a set of contexts based, at least in part, on a previous quantized coefficient in the sequence of quantized coefficients.</p>

Claims	Identification
the sequence of quantized coefficients; and	<p data-bbox="562 203 1167 264" style="text-align: center;">V. THE SIMPLIFIED RDOQ IN HEVC REFERENCE SOFTWARE</p> <p data-bbox="480 282 1234 440">In the RDOQ implemented HEVC test model (HM16) [20] the encoder uses only estimated values of introduced distortion (represented by square quantization error) and a number of bits required to encode selected transform coefficient, coefficient group or transform unit.</p> <p data-bbox="480 461 1234 589">For example, for every of the examined coefficient magnitude the encoder calculates the cost <math>RD\_cost(L, c)</math> of encoding the coefficient <math>c</math> with the magnitude <math>L</math> according to (2) and chooses the case with the lowest RD cost.</p> $RD\_cost(L, c) = est\_D(L, c) + \lambda \cdot est\_B(L, c), \quad (2)$ <p data-bbox="480 716 1188 976">where:  <math>c</math> – transform coefficient identifier,  <math>L</math> – value of quantized transform coefficient <math>c</math>,  <math>RD\_cost(L, c)</math> – cost of quantization coefficient <math>c</math> to value <math>L</math>,  <math>est\_D(L, c)</math> – square quantization error,  <math>est\_B(L, c)</math> – estimated number of bits needed do encode coefficient <math>c</math> quantized to value <math>L</math>,  <math>\lambda</math> – Lagrange multiplier.</p> <p data-bbox="480 992 1230 1057">The detailed description of RDOQ implementation in HEVC can be found in [21].</p> <p data-bbox="462 1105 1556 1138">Source: Rate-distortion optimized quantization in HEVC: Performance Limitations, 4.</p>

Claims	Identification
	<div data-bbox="464 175 1745 529"> <p><b>4 Abbreviations and acronyms</b></p> <p>For the purposes of this Recommendation   International Standard, the following abbreviations and acronyms apply:</p> <p>ATSC      Advanced Television Systems Committee</p> <p>B          Bi-predictive</p> <p>BLA        Broken Link Access</p> <p>BPB        Bitstream Partition Buffer</p> <p><u>CABAC      Context-based Adaptive Binary Arithmetic Coding</u></p> </div> <p data-bbox="464 537 888 570">HEVC Specification (H.265), 14.</p> <div data-bbox="464 574 1833 1183"> <p><b>9.3 <u>CABAC parsing process for slice segment data</u></b></p> <p><b>9.3.1 General</b></p> <p>This process is invoked when parsing syntax elements with descriptor <code>ac(v)</code> in clauses 7.3.8.1 through 7.3.8.12.</p> <p>Inputs to this process are a request for a value of a syntax element and values of prior parsed syntax elements.</p> <p>Output of this process is the value of the syntax element.</p> <p>The initialization process as specified in clause 9.3.2 is invoked when starting the parsing of one or more of the following:</p> <ol style="list-style-type: none"> <li>1. the slice segment data syntax specified in clause 7.3.8.1,</li> <li>2. the CTU syntax specified in clause 7.3.8.2 and the CTU is the first CTU in a tile,</li> <li>3. the CTU syntax specified in clause 7.3.8.2, <code>entropy_coding_sync_enabled_flag</code> is equal to 1 and the associated luma CTB is the first luma CTB in a CTU row of a tile.</li> </ol> <p>The parsing of syntax elements proceeds as follows:</p> <p>When <code>cabac_bypass_alignment_enabled_flag</code> is equal to 1, the request for a value of a syntax element is for either the syntax elements <code>coeff_abs_level_remaining[ ]</code> or <code>coeff_sign_flag[ ]</code> and <code>escapeDataPresent</code> is equal to 1, the alignment process prior to aligned bypass decoding as specified in clause 9.3.4.3.6 is invoked.</p> </div> <p data-bbox="464 1192 1008 1224">Source: HEVC Specification (H.265), 203.</p>

Claims	Identification
	<p>The basic design of CABAC involves the key elements of binarization, context modeling, and binary arithmetic coding. These elements are illustrated as the main algorithmic building blocks of the CABAC encoding block diagram in Fig. 1. Binarization maps the syntax elements to binary symbols (bins). Context modeling estimates the probability of each non-bypassed (i.e., regular coded) bin based on some specific context. Finally, binary arithmetic coding compresses the bins to bits according to the estimated probability.</p>  <p>The diagram illustrates the CABAC encoding process. A syntax element is input to a Binarizer, which outputs a sequence of bins <math>(b_1, b_2, \dots, b_n)</math>. These bins are processed serially. A switch determines if a bin is regular or bypassed. For regular bins, a Context Memory provides context information <math>b_{i-1}</math> to a Probability Estimator &amp; Assigner. The estimator uses an adaptive probability estimation function <math>P_{LPS}^{(i-1)} = F(b_{i-1}, v_{MPS}^{(i-1)}, p_{LPS}^{(i-1)})</math> to estimate the probability <math>p_{LPS}^{(i)}</math>. The bin <math>b_i</math> is then encoded by a Regular Arithmetic Encoder using the estimated probability. For bypassed bins, the bin <math>b_j</math> is encoded by a Bypass Arithmetic Encoder using a fixed probability <math>p=0.5</math>. The outputs of both encoders are multiplexed (Mux) together. Red annotations highlight potential throughput bottlenecks: 'context derivation' from memory, 'adaptive prob. estimation' in the probability estimator, 'bin-by-bin processing' in the regular encoder, and 'serial processing of bins' at the binarizer output.</p> <p>Fig. 1: CABAC block diagram (from the encoder perspective): Binarization, context modeling (including probability estimation and assignment), and binary arithmetic coding. In red: Potential throughput bottlenecks, as further discussed from the decoder perspective in Sect. 3.2.</p> <p>Source: Entropy Coding in HEVC, 4.</p>



Claims	Identification
	<p data-bbox="478 180 1367 215"><b><i>2.2 Context Modeling, Probability Estimation and Assignment</i></b></p> <p data-bbox="478 264 1434 841">By decomposing each non-binary syntax element value into a sequence of bins, further processing of each bin value in CABAC depends on the associated coding-mode decision, which can be either chosen as the regular or the bypass mode (as described in Sect. 2.3). The latter is chosen for bins, which are assumed to be uniformly distributed and for which, consequently, the whole regular binary arithmetic encoding (and decoding) process is simply bypassed. In the regular coding mode, each bin value is encoded by using the regular binary arithmetic coding engine, where the associated probability model is either determined by a fixed choice, based on the type of syntax element and the bin position or <u>bin index (binIdx)</u> in the binarized representation of the syntax element, or adaptively chosen from two or more probability models depending on the related side information (e.g. spatial neighbors as illustrated in Fig. 1, component, depth or size of CU/PU/TU, or position within TU). Selection of the probability model is referred to as context modeling. As an important design decision, the latter case is generally applied to the most frequently observed bins only, whereas the other, usually less frequently observed bins, will be treated using a joint, typically zero-order probability model. In this way, CABAC enables selective adaptive probability modeling on a sub-symbol level, and hence,</p> <p data-bbox="478 873 940 902">Source: Entropy Coding in HEVC, 6.</p>
<p data-bbox="100 911 449 1344">10[f] change a value of one of said quantized coefficients of the obtained sequence to produce a new sequence of quantized coefficients, so that a resulting rate-distortion cost for the new sequence of quantized coefficients is smaller than a rate-distortion cost for the obtained sequence.</p>	<p data-bbox="478 911 2001 1052">Acer-branded devices implement a video encoder that comprises a video encoding application executable by the processor and which, when executed, configures the processor to change a value of one of said quantized coefficients of the obtained sequence to produce a new sequence of quantized coefficients, so that a resulting rate-distortion cost for the new sequence of quantized coefficients is smaller than a rate-distortion cost for the obtained sequence.</p>

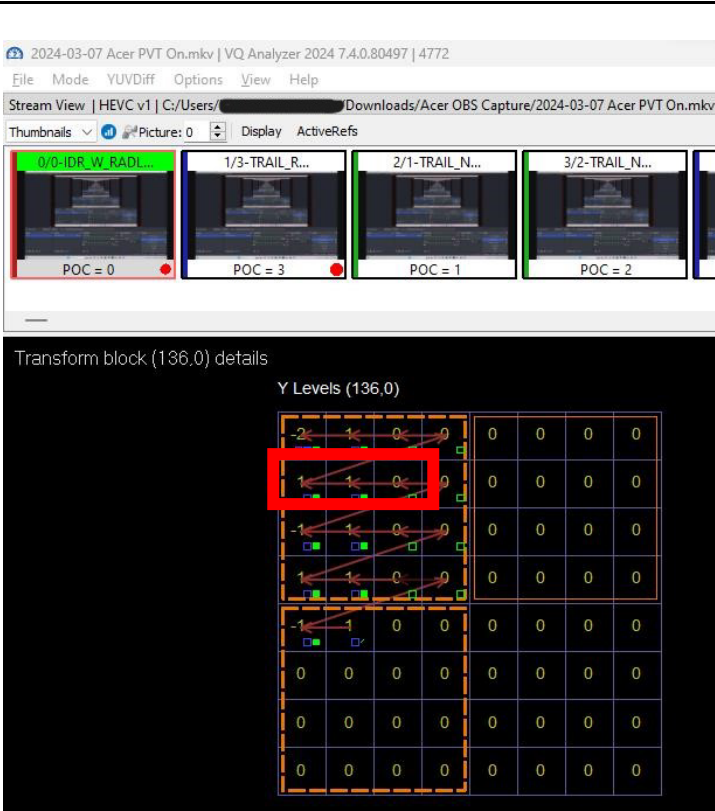
Claims	Identification
	<p style="text-align: center;">IV. THE RDOQ IN HEVC</p> <p>The RDOQ has been included in the HEVC reference software (HM) and intensively used during HEVC development and performance. This section describes the RDOQ algorithm adapted to HEVC.</p> <p>...</p> <p><i>A. Quantization of transform coefficients</i></p> <p>In this stage the encoder performs calculation for each of transform coefficients separately. In the first step, the encoder calculates the value <i>Level</i> by quantizing the magnitude of transform coefficient by using the uniform quantizer without dead zone. <u>In the next step, the encoder considers two additional magnitudes of the analyzed quantized coefficient: <i>Level-1</i> and <i>0</i>. For every of the mentioned coefficient magnitudes, the encoder calculates the RD cost of encoding the coefficient with the selected magnitude and chooses the one with the lowest RD cost.</u></p> <p>Source: Rate-distortion optimized quantization in HEVC: Performance Limitations, 3.</p> <p>Acer-branded devices perform rate-distortion optimization. For example, the following depicts video frames with Psycho Visual tuning disabled (on the left) and Psycho Visual tuning enabled to enable rate-distortion optimization (on the right).</p>

Claims

Identification



Quantized coefficients for HEVC encoded video with Psycho Visual tuning disabled



Quantized coefficients for HEVC encoded video with Psycho Visual tuning enabled (to enable rate-distortion optimization)

Source: Internal Testing of Acer Predator Helios Neo 16 Gaming Laptop.

After enabling the psycho-visual setting (to enable rate-distortion optimization), the magnitude of the quantized coefficient for some of the coefficients is decreased by 1 and/or reduced to 0. *Compare* the quantized coefficients in the green box with the quantized coefficients in the red box.

The change in magnitude of the quantized coefficients when Psycho Visual Tuning is enabled indicates rate-distortion optimization.